

# **Climate Data and Analyses for the Study of Natural Variability and Anthropogenic Change**

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The aims of this project are to improve climate databases for the monitoring of on-going climate change and to use these databases (and paleoclimatic extensions) for the validation of model integrations using coupled climate models. One of the foci is further study of the range of natural climate variability, against which detection of anthropogenic factors is attempted. There are 6 main areas of study:

1. Continued updating and improvement of the database of surface temperatures. During the first year of the project a thorough reanalysis of the basic surface temperature dataset will be undertaken, incorporating extensive datasets that have been produced by groups and national meteorological services around the world. Up to 1000 extra stations will be added to the basic dataset resulting in more extensive and improved surface temperature data.
2. Recent observational climate analyses have noticed that the influence on surface temperatures of phenomenon such as El Niño/Southern Oscillation (ENSO) and the North Atlantic Oscillation (NAO) varies with time. Responses appear much stronger since the 1960s and before the 1920s, but much weaker in between. We will investigate these changes in relationships to determine if they are real, statistical artefacts or just due to less reliable data.
3. Long daily temperature datasets have been developed for eight sites in Europe, each extending back to the 18<sup>th</sup> century. We propose to analyse these data, together with long monthly data from some European countries, to extend the gridded data back to 1800 and to consider whether there have been long-term changes in the frequency of extremes. The results will be compared with similar data from long coupled climate model integrations.
4. Europe has both long climate records and extensive paleoclimatic records, particularly from tree-ring density data. These sources have been enhanced recently by borehole-estimates of temperature that provide temperatures at the century timescale. We will analyze all these sources to assess the true level of temperature change in Europe in the 17<sup>th</sup> and 18<sup>th</sup> centuries. At present there are some interesting differences that need interpretation, particularly over Fennoscandia during the period 1750-1850.
5. Coupled climate models produce extensive datasets of climate variability, both for the past 500 years and the next 100 years. Before these can be accepted it is vital to assess whether the models produce the right levels of natural variability, particularly on decadal-to-century timescales. We propose to analyse these changes using both the long European instrumental records and the longer records of past change for the Northern Hemisphere for the last 500 years from tree-ring density information. Past instrumental and proxy climatic information are our only sources of what has really happened in the past, and given correct estimates of past natural forcing (from solar output variations and explosive volcanic

eruptions), coupled models ought to be able to reproduce the basic patterns of what has happened.

6. Several recent studies have suggested that some important changes in the number of daily and weather timescale extremes have occurred. We will address this issue by looking both at extremes from coupled climate models and observational changes that have been seen. Issues here include the reliability of the model at these timescales and unusualness of recent extremes. What may seem unusual in the last 50 years may be less so in longer records. Here again, we propose to use the longer records of daily temperature and precipitation available from Europe.